2-E-27

# OPERATING INSTRUCTIONS

## MODEL 734
## MODEL 735
## 3 MC COUNTER/TIMERS

MP MASTER
MA29725

ELDORADO ELECTRONICS

601 Chalomar Road Concord, California U.S.A. / Telephone: (415) 686-4200

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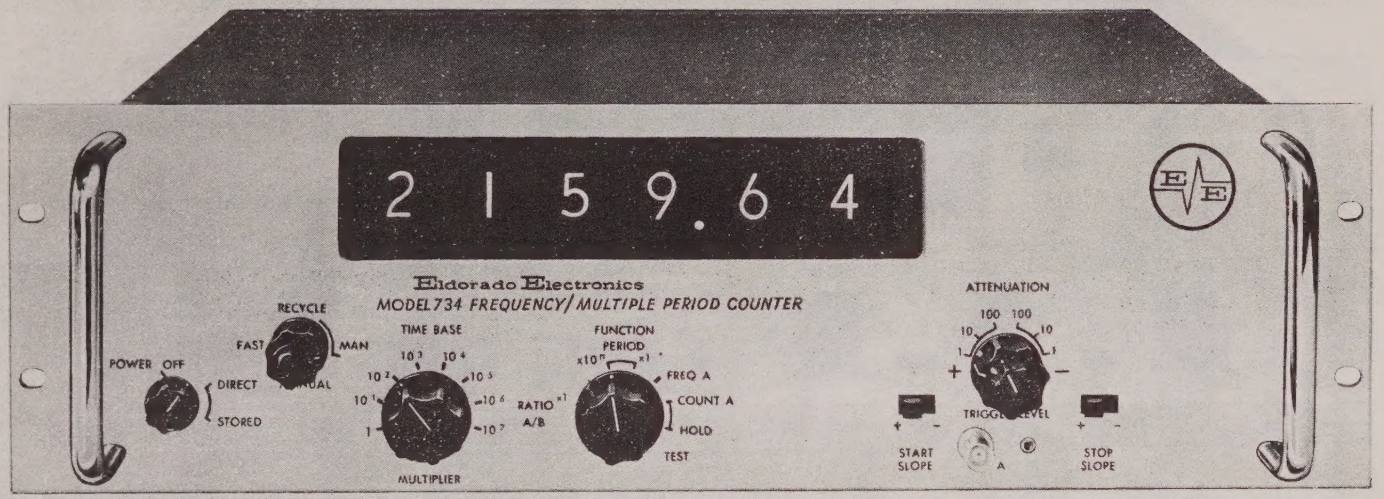
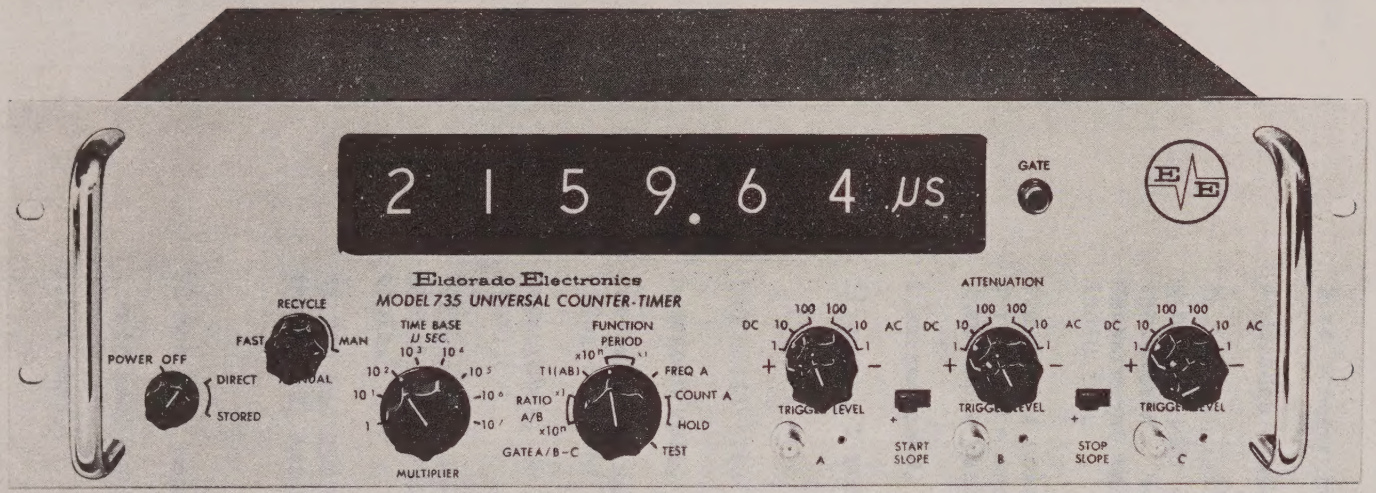



MODEL 734 3 MC FREQUENCY/MULTIPLE PERIOD COUNTER




# MODEL 735 3 MC UNIVERSAL COUNTER/TIMER

# SECTION 1

# SPECIFICATIONS

| | |
|---|---|
| INPUT FREQUENCY RANGE | 0 to 3 megacycles. |
| DECADES | 6 decades standard. |
| DISPLAY | In-line Nixie[R] tubes with polarized window filter and variable decimal point indication. Model 735 also contains a Measurement Unit Window and Gate Time indicator. |
| DISPLAY STORAGE | Provides a continuous output reading, even during gate intervals. Digits change only when input variations occur. |
| RESOLUTION | 1 microsecond. |
| ACCURACY | ±1 count, ± reference frequency stability. |
| SIGNAL CHANNELS | |
| Sensitivity: | 100 millivolts rms. |
| Impedance: | 1 megohm/volt, shunted by 40 pf. |
| Trigger Level: | Continuously adjustable through the operating range of (-)1 volt to (+)1 volt. |
| Coupling: | Selectable, dc or ac (0.1 mf series capacitor). |
| Attenuation: | Selectable ranges of X1, X10, and X100, with positive or negative polarity controls. |
| Overload: | 35,200 and 250 volts peak respectively for the 1, 10, and 100 attenuator settings. |
| MODEL 734 RATIO CHANNEL | |
| Frequency Range: | 50 cps to 1 megacycle. |
| Sensitivity: | 1 volt peak to peak. |
| Impedance: | 1.5 K ohms. |
| FUNCTIONS | |
| Frequency: | 0 to 3 megacycles. |

[R] Burroughs Corporation

| | |
|---|---|
| Count (Totalizing): | 0 to 3 megacycles. |
| Period: | In increments of 1 microsecond to $10^7$ seconds, in decade steps. |
| Multiple Period: | 10 to $10^7$ periods, by decades, in 1 microsecond increments. |
| Pulse Width: | 1 microsecond to $10^7$ seconds. |
| Time Interval (Model 735): | 1 microsecond to $10^7$ seconds. |
| Ratio A/B (Model 735): | Both channels, 0 to 3 megacycles. |
| Multiple Ratio: | 10 to $10^7$, by decades. |
| Gated Counter (Model 735): | 0 to 3 megacycles. |
| Test: | Counts 1 megacycle for all standard gate times. |

TIME BASE

| | |
|---|---|
| Oscillator: | 1.0 megacycle. |
| Stability: / | 1 part $10^6$ per day.<br>10 parts $10^6$ over operating range of -20 degrees C to +65 degrees C. |

OUTPUTS

| | |
|---|---|
| Printout: | Code 1-2-4-8 BCD, dc levels "0" = (-) 0.3 volts, "1" = (-) 9 volts, 15 K ohm source impedance. Print command is automatic at end of count cycle. |
| Print Command: | 15 millisecond pulse, (±) 10 volts to 0 volts from a 15 K ohm source impedance. |
| Oscillator Monitor: | 1.0 megacycle at 1 volt rms from a 1 K ohm source impedance. |
| Time Base: | 2.5 volts peak to peak from a 270 ohm source at frequency set by time base switch. |
| Scope Pulse: | Oscilloscope marker/output trigger pulses of (+) 10 volts peak with 0.2 microsecond duration are available on the front panel. |

RESET

| | |
|---|---|
| Manual: | Front panel pushbutton. |

| | |
|---|---|
| Remote: | (-) 10 volt pulse with less than 1 microsecond rise time, 1 microsecond duration, into 1 K ohm. |
| Automatic: | When Recycle control is set in the variable position. Recycle rate is 0.2 to 15 seconds. |
| TEMPERATURE RANGE | |
| Operating: | -20°C to +65°C. |
| Storage: | -40°C to +85°C. |
| SIZE | 5 1/4" High, 19" Panel, 17" Deep, and 17" Wide. |
| WEIGHT | 30 lbs. |
| POWER | 115/230 vac, 50/60 cps, 65 watts. |
| OPTIONS | |
| A: | Internal Oscillator, one part $10^7$ per day stability. |

# SECTION 2

# OPERATING INSTRUCTIONS

## 2.1 GENERAL

Model 734/735 Counter/Timers were developed to provide the user with wide operating capability. Designed to meet the stringent requirements of laboratory and systems applications, these instruments have a conservative counting rate of 0 to 3 megacycles.

Operating functions of the instruments include: FREQUENCY and COUNT (Totalizing), 0 to 3 megacycles; PERIOD, in increments of 1 microsecond to $10^7$ seconds in decade steps; MULTIPLE PERIOD, 10 to $10^7$ periods, by decades, in 1 microsecond increments; PULSE WIDTH, 1 microsecond to $10^7$ seconds; MULTIPLE RATIO, 10 to $10^7$, by decades; and TEST. Also, Model 735 includes the following additional functions: TIME INTERVAL, 1 microsecond to $10^7$ seconds; RATIO A/B, 0 to 3 megacycles; and GATED COUNTER, 0 to 3 megacycles.

Both instruments feature display storage which provides continuous readout even during gate intervals. Digit changes occur only when variations are experienced at the input. Recycle rate of the units is continuously variable from 0.2 to 15 seconds or infinite. Reset is performed manually by pushbutton, remotely by signal cable, or automatically with Recycle circuit. Oscilloscope marker/output trigger pulses are available on front panel pin jacks.

Input levels of up to 250 volts peak are accepted and attenuated in ranges of 1, 10, and 100. Trigger level controls and slope switches adjust data signals for the input circuits. The time base for Model 734/735 is derived from a temperature controlled crystal and oscillator having stability of 1 part in $10^6$ per day.

## 2.2 INSTALLATION

The Model 734/735 contains a time base oscillator crystal which is temperature stabilized in an oven. The oven heating element is connected directly to the power cord and by-passes the instrument power switch. Under normal conditions, it is desirable to have the oven fully stabilized at all times by leaving the line cord connected to a power outlet.

a. Connect the line cord to a 115 volt, 50/60 cps power source. Under all conditions, allow the crystal oven at least 2 hours to warmup before operating the instrument. Best performance is achieved if the line cord is continuously connected to the power line.

b. Provide input signals of either polarity, with amplitude of at least 100 millivolts rms to the front panel input connectors. Input coupling to each channel may be either AC or DC, as selected on the front panel switches marked ATTENUATION. Voltage overload for the input channels is 35, 200, and 250 volts peak respectively for the 1, 10, and 100

attenuator settings. Trigger level is continuously adjustable through the operating range of (-)1 volt to (+)1 volt.

c. If remote reset is desired, connect this function to the rear panel BNC connector marked REMOTE RESET INPUT. Provide a negative 10 volt pulse with less than 1 microsecond rise time, 1 microsecond duration, into 1 K ohm.

d. If an external high accuracy time base is utilized in place of the internal unit provided, connect this to the rear panel BNC connector marked OSCILLATOR and turn the slide switch from INTERNAL to EXTERNAL. The OSCILLATOR input accepts any frequency in the range of 50 cps to 1.0 megacycle.

e. If a 1 megacycle monitor signal from the internal or external oscillator is required, this is available on the rear panel connector marked 1 MC MONITOR.

f. Time base signals of .1, 1, 10, 100, 1000, 10,000 cps, 100 Kc and 1 Mc are available on the rear panel BNC connector marked TIME BASE OUTPUT. These frequencies are selectable by the front panel function switch marked TIME BASE.

g. OPTIONAL: Connect the printout cable to the rear panel Amphenol connector marked PRINTER OUTPUT. The printer output code is 1-2-4-8 BCD from a 15 K ohm source, "0" = (-)0.3 volt, "1" = (-)9 volts. See SECTION 4, DRAWING INDEX AND DRAWINGS, for Printer Readout Connector Pin Designation information. The print command, consisting of a 15 millisecond pulse from a 15 K ohm source is available on Pin 48 (negative going), and Pin 23 (positive going) of the Amphenol connector marked PRINTER OUTPUT. A (-)10 volt Printer Reference output is available on Pin 24 while Ground Reference is available on Pin 25 of the same connector.

**WARNING**

This instrument contains a cooling fan and air filter to maintain optimum performance of the unit in various ambient environments. The air filter must be removed and cleaned once every 60 days so that air flow will not be restricted. After cleaning, the filter should be coated with an adhesive such as R.P. Filter Coat. More frequent cleansing of the filter element may be required when the instrument is operated in unusually severe environments.

## 2.3 OPERATING CONTROLS

ATTENUATION SWITCHES-(Model 734, Channel A; Model 735, Channels A, B, and C)
These switches attenuate input signals to the levels consistent with reliable input trigger operation. Input signals may be coupled directly (DC switch setting), or may be coupled through a 0.1 mf capacitor (AC switch setting).

TRIGGER LEVEL CONTROLS-(Model 734, Channel A; Model 735, Channels A, B, and C)
These potentiometer controls are continuously adjustable through the operating range of (-)1 volt to (+)1 volt. In conjunction with the Attenuation switches, these controls set the proper input trigger point for operation with the input signals.

START/STOP SLOPE SWITCHES
These switches select the triggering slope of input signals used in Period, Pulse Width, Time Interval, Multiple Period, Gated Counter, Ratio and Multiple Ratio measurements. When set in the positive position, a channel triggers only on the positive going slope of the input signal. If set to the negative position, a channel is triggered only by the negative going slope of the input signal.

OSCILLOSCOPE MARKER/OUTPUT TRIGGER PULSES
These signals provide the Model 734/735 Counter user with additional flexibility to visually determine the trigger point on a measured waveform. Oscilloscope marker/output trigger pulses of (+)10 volts peak with 0.2 microsecond duration are available on the front panel pin jacks located adjacent to the input channels.

GATE LAMP INDICATOR-(Model 735)
A gate lamp indicator, located next to the display readout window, turns ON during all gating intervals. This lamp will not appear to light on fast gate settings since the filament of the lamp cannot incandesce to a visual level before the gate period ends.

FUNCTION SWITCH
This switch selects the various operating modes of the instrument. Function selection will sometimes be influenced by the requirements of measurement accuracy. To achieve maximum accuracy, FUNCTION and TIME BASE switch settings should provide for maximum accumulation of digits on the visual readout. When measuring a high frequency signal in the Frequency mode, use a slow time base setting. If a low input frequency is to be measured, it is preferable to make this measurement in the Period or Multiple Period modes. Rough measurements can be made at settings between these extremes.

TIME BASE SWITCH
This switch selects the division factor for a signal coupled to the time base decades and is used in the following measurements: Frequency, Period, Multiple Period, Multiple Ratio, and Test. It is also used for Time Interval Measurements in the Model 735. The divided time base frequency used internally to control the count period, is also available on the rear panel BNC connector marked TIME BASE OUTPUT.

In Multiple Period mode, the input signal is divided by the time base decades in accordance with TIME BASE switch settings while the internal oscillator is counted and displayed on the visual readout. Multiple Ratio operation is similar except that the internal oscillator is not used. Instead, the signal on Channel A is counted and displayed on the visual readout while the signal on Channel B is coupled through the time base decades.

RESET BUTTON
This button resets the entire instrument and returns the visual readout display to zero.

RECYCLE CONTROL

This control sets the visual display time of 0.2 to 15 seconds, or in the extreme clockwise position, to MANUAL reset. The instrument is automatically reset at the end of a variable display period as selected by this control. When set in the MANUAL position, the visual reading will remain indefinitely until the instrument is manually reset.

POWER SWITCH

The POWER/DIRECT/STORED switch turns the instrument power ON and OFF. When set in the DIRECT position, all visual readout tubes are reset at the end of a display period. If set in the STORED position, the visual readout tubes change only at the beginning of each display period if variations occur at the input.

MEASUREMENT UNIT WINDOW - (Model 735)

The Measurement Unit Window directly indicates the units of measure for a signal being applied to the input. This eliminates the need to check TIME BASE and FUNCTION switch settings to determine the units of measure. When the function switch is set in the FREQUENCY position, the window indicates c/s (cycles per second ), kc (kilocycles), and Mc (megacycles). When set in the PERIOD position, the window indicates units of time in sec (seconds), ms (milliseconds) or μs (microseconds). MULTIPLE PERIOD indications are in μs (microseconds) or ns (nanoseconds). TIME INTERVAL measurements are indicated in sec (seconds), ms (milliseconds), or μs (microseconds).

DECIMAL POINT INDICATORS

Variable decimal point indicators, located in the readout window, allow the operator to read the output directly in the measurement units indicated.

## 2.4 OPERATION

a. Turn the POWER switch to ON. A random display will immediately appear on the readout tubes.

b. Check the front panel control switches to verify START/STOP SLOPE, ATTENUATION, FUNCTION and TIME BASE switch settings.

c. Depress the RESET button. All readout tubes will reset to the zero condition. A signal applied to the rear panel BNC connector marked REMOTE RESET INPUT will produce the same result.

d. Introduce input signals to the front panel connectors. With the front panel RECYCLE control set in the extreme clockwise position, the visual reading will remain until the unit is manually reset. The variable recycle period of 0.2 to 15 seconds is selected by turning this control in a counter-clockwise direction.

e. OPTIONAL: Manually or automatically actuate the external printout equipment upon completion of the readout cycle. The printer readout should exactly duplicate the visual readout. Automatic print command signals are available at the rear panel Amphenol connector marked PRINTER OUTPUT.

## 2.5 OPERATING MODES

### TEST MODE - 1 MEGACYCLE

Operation of the instrument can be verified by turning the FUNCTION switch to the TEST mode. Reset the instrument. Signals from the 1 megacycle oscillator are counted in the decades for a period determined by the TIME BASE switch setting. During any counting period, the gate light indicator will be ON, but, will turn OFF when the gate period ends. The Model 735 Measurement Unit Window will not be lit in the TEST mode.

**FRONT PANEL CONTROLS**

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE | Variable |
| FUNCTION | TEST |
| ATTENUATOR | Not used |
| START SLOPE | Not used |
| STOP SLOPE | Not used |
| INPUT | Not used |

The standard Model 734/735 equipped with 6 digits will provide the readings indicated while in the TEST mode. When the TIME BASE switch is set in the $10^6$ or $10^7$ position, the most significant digits are assumed to be located off the left side of the readout window.

| TIME BASE SETTING | VISUAL READING |
|---|---|
| 1 | 1 |
| 10 | 10 |
| $10^2$ | 100 |
| $10^3$ | 1,000 |
| $10^4$ | 10,000 |
| $10^5$ | 100,000 |
| $10^6$ | 1,000,000 |
| $10^7$ | 10,000,000 |

### COUNT AND HOLD MODES - 0 TO 3 MEGACYCLES

With input signals at Channel A, adjust the ATTENUATION and TRIGGER LEVEL controls for the proper signal amplitude. Turn the FUNCTION switch to the HOLD position and reset the instrument. When the switch is turned to the COUNT position, the instrument will commence to totalize until the FUNCTION switch is returned to the HOLD position, at which time counting will cease. The count indicated on the visual readout will not change unless the instrument is reset or the FUNCTION switch is again placed in the COUNT position. The instrument may be reset after each cycle, or the count from the first cycle may be accumulated with the count of the second cycle, etc.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual |
| TIME BASE | Not used |
| FUNCTION | COUNT A |
| | HOLD |
| ATTENUATOR | Channel A |
| START SLOPE | Not used |
| STOP SLOPE | Not used |
| INPUT | Channel A |

FREQUENCY MODE - 0 TO 3 MEGACYCLES

With input signals to Channel A, turn the FUNCTION switch to FREQ, adjust the input controls and reset the instrument. The Model 734/735 will then count input signals from 0 to 3 megacycles. Before each reading, the instrument can be reset by the front panel RESET pushbutton, by the rear panel REMOTE RESET INPUT, or automatically by the RECYCLE control.

The Model 735 Measurement Unit Window, in conjunction with the variable decimal point indicators, reads out directly in c/s, (cycles per second); kc, (kilocycles); or Mc, (megacycles).

Model 734 Frequency readings are indicated directly with variable decimal points and red designator markings around the TIME BASE switch.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE | Variable |
| FUNCTION | FREQ A |
| ATTENUATOR | Channel A |
| START SLOPE | Not used |
| STOP SLOPE | Not used |
| INPUT | Channel A |

PERIOD/PULSE WIDTH MODE - 1 MICROSECOND TO $10^7$ SECONDS

Provide input signals to Channel A and position the control switches as indicated. Reset the instrument. In this condition Model 734/735 measures the Period of periodic wave forms or pulses applied to the input. The Period measurement begins at a point determined by the attenuation/trigger level and slope switch settings. The measurement can start on the positive leading edge of the input wave and end on the positive leading edge of the next wave. The same is true with negative going wave/pulse forms.

Pulse Width measurements may also be made in the PERIOD mode. To measure the width of a positive going pulse, set the START SLOPE switch to the (+) position and the STOP SLOPE switch to the (-) position. When measuring the width of a negative going pulse, these switches are reversed.

The Model 735 Measurement Unit Window, in conjunction with the variable decimal point indicators, reads out in units of: sec, (seconds); ms, (milliseconds); or μs, (microseconds).

Model 734 Period readings are in microsecond units multiplied by the TIME BASE switch setting, with no decimal point indication.

Oscilloscope marker/output trigger pulses of (+)10 volts peak with 0.2 microsecond duration are available on the front panel tip jacks adjacent to the input connectors.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE | Variable |
| FUNCTION | PERIOD |
| ATTENUATOR | Channel A |
| START SLOPE | (+) or (-) |
| STOP SLOPE | (+) or (-) |
| INPUT | Channel A |

PERIOD X$10^n$ - 10 TO $10^7$ PERIODS

Greater accuracy of period measurements may be obtained with Model 734/735 when the instrument is operated in Multiple Period mode. With the TIME BASE switch turned to the 1 position, readout will be identical to a normal Period measurement. Accuracy of Multiple Period measurements is then increased each time by a factor of 10 as the TIME BASE count down period is lengthened.

With the front panel controls positioned as indicated, provide input signals to Channel A and reset the instrument. Multiple Period may be measured from either the positive or negative portion of the input cycle, depending on the START SLOPE switch setting. (NOTE: The STOP SLOPE switch is not used).

The Model 735 Measurement Unit Window, in conjunction with variable decimal point indicators, reads out in μs, (microseconds); or ns, ( nanoseconds).

Model 734 Multiple Period readings are indicated directly in microsecond units with variable decimal points. Decimal indication for $10^6$ and $10^7$ TIME BASE settings is assumed to be located off the left side of the readout window.

An oscilloscope marker/output trigger pulse is available at the front panel tip jack adjacent to the input connector for observation on an oscilloscope.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE | Variable |
| FUNCTION | PERIOD X$10^n$ |
| ATTENUATOR | Channel A |
| START SLOPE | (+) or (-) |
| STOP SLOPE | Not used |
| INPUT | Channel A |

RATIO MODE - 0 TO 3 MEGACYCLES (MODEL 735)

Set the front panel switches as indicated while providing input signals to Channels A and B. Reset the instrument. Since the ratio is determined by A/B, it is important that the higher frequency be connected to Channel A, while the lower frequency is connected to Channel B. Check the input signal levels to Channels A and B to verify that the proper conditions for triggering are present. Should either channel fail to trigger properly, the ratio reading will be in error.

The Model 735 reads out a whole number without Measurement Unit Window or decimal point indication.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE | Not used |
| FUNCTION | RATIO X1 |
| ATTENUATOR | Channels A and B |
| START SLOPE | (+) or (-) |
| STOP SLOPE | (+) or (-) |
| INPUT | Channels A and B |

MULTIPLE RATIO MODE - 10 TO $10^7$

Accurate ratio measurements may be made with the Model 734/735 by using the MULTIPLE RATIO MODE. On the Model 735, Channel A and B inputs are used while on the Model 734, Channel A and the rear panel BNC connector marked OSCILLATOR are utilized. When using the Model 734 OSCILLATOR input, the rear panel slide switch must be set in the EXTERNAL position. Provide input signals and reset the instrument. (NOTE: The STOP SLOPE switch is not used.)

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE FUNCTION | Variable MULTIPLE RATIO |
| ATTENUATOR | Channels A and B |
| START SLOPE | (+) or (-) |
| STOP SLOPE | Not used |
| INPUT | Channels A and B |

Position the front panel controls as indicated. Greater accuracy, by a factor of 10, is obtained each time the TIME BASE count down period is increased. In Multiple Ratio, the input to Channel A need not be higher than the input to Channel B, except when the TIME BASE switch is in the 1 position. It is important that Channel A and B input levels be checked to verify proper triggering before making Multiple Ratio measurements since failure to do so may result in erroneous readings.

The Model 735 reads out a whole number which is then divided by the TIME BASE switch setting for decimal point location.

Model 734 Multiple Ratio readings are indicated directly with variable decimal points. Decimal indication for $10^6$ and $10^7$ TIME BASE settings is assumed to be off the left side of the readout window.

TIME INTERVAL MODE - 1 MICROSECOND TO $10^7$ SECONDS (MODEL 735)

Connect START input signals to Channel A and STOP input signals to Channel B of the Model 735. Position the front panel controls as shown and reset the instrument. An input START pulse at Channel A initiates counting by opening a gate which allows pulses from the time base to be counted. The measured time interval is then terminated when a STOP pulse is applied to Channel B. When measuring time intervals of short duration, the TIME BASE switch should be turned to the 1 position. If longer time intervals are to be measured, this switch should be turned in the clockwise direction. Each time the switch is moved clockwise from the 1 position, the TIME BASE output frequency decreases by a factor of 10.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual or Fast |
| TIME BASE FUNCTION | Variable TI[A-B] |
| ATTENUATOR | Channels A and B |
| START SLOPE | (+) or (-) |
| STOP SLOPE | (+) or (-) |
| INPUT | Channels A and B |

The Model 735 Measurement Unit Window in conjunction with the decimal indicators provides direct readings

in sec, (seconds); ms, (milliseconds); or μs, (microseconds). It is important that Channel A and B input levels be checked to verify proper triggering before making Time Interval measurements. Failure to do so may result in erroneous readings.

GATED COUNTER MODE - 0 TO 3 MEGACYCLES (MODEL 735)

With the front panel controls set as indicated, provide time base signals to Channel A, a START control signal to Channel B, and a STOP control signal to Channel C. Reset the instrument. The Model 735 gate light turns ON as the START pulse arrives and turns OFF when the STOP pulse is received. The unit will totalize any input frequency up to 3 megacycles in Channel A, for a period determined by Channels B and C. Measurement unit and decimal point indication is not available in this mode of operation. In the GATED COUNTER MODE, it is important to verify that inputs to Channels A, B and C are of the required amplitude to properly trigger the input circuits.

FRONT PANEL CONTROLS

| SWITCH | POSITION |
|---|---|
| RECYCLE | Manual |
| TIME BASE | Not used |
| FUNCTION | GATE[A/BC] |
| ATTENUATOR | Channels A, B and C |
| START SLOPE | (+) or (-) |
| STOP SLOPE | (+) or (-) |
| INPUT | Channels A, B and C |

# SECTION 3

# CALIBRATION

## 3.1 GENERAL

Model 734/735 Counter/Timers need only minimum maintenance, however, normal aging of electronic components occasionally requires that instrument calibration be checked to verify specification accuracy. Therefore, general calibration procedures are included in this section as a guide to restoring the instrument to optimum performance.

## 3.2 TEST EQUIPMENT

Instrument calibration procedures are not complex and require but a few moments of time for verification or adjustment.

The following equipment is required for the calibration procedures.

a. (1) Laboratory oscilloscope, 10 megacycles or greater resolution.

b. (1) Vacuum-tube voltmeter.

c. (1) Frequency Time Standard, one part in $10^8$ per day or better.

## 3.3 POWER SUPPLY CALIBRATION

It is essential that power supply output voltages be checked before proceeding with adjustment of the time base oscillator. All power supply voltages should be measured at the output side of the fuse block located near the center of the power supply chassis. If any voltage does not check within the tolerances indicated, the respective regulator trim potentiometer will require adjustment.

a. Connect the power supply regulator board, located on the power supply chassis, into the printed circuit extender board provided with the instrument. Adjust power supply voltages in the order indicated below.

| ADJUST SEQUENCE | TRIMMER POTENTIOMETER | VOLTAGE | REGULATION |
|---|---|---|---|
| 1 | R9 | (+)12 volts | ±1% |
| 2 | R17 | (-)12 volts | ±1% |
| 3 | R15 | (-)3 volts | ±1% |
| 4 | none | 300 volts | ±20% |

b. It is recommended that upon completion of the adjustment procedure in (a.) above, the procedure be repeated again to insure that no interaction has occurred.

## 3.4 TIME BASE CALIBRATION

Model 734/735 time base calibration should be accomplished with Frequency Time Standard having stability of one part in $10^8$ per day or better. To insure highest adjustment accuracy, Model 734/735 must remain connected to a power outlet for at least 2 to 3 hours prior to adjustment of the oscillator trimmer capacitor.

METHOD I

a. With the instrument turned ON, connect a cable from the Model 734/735 rear panel BNC connector marked 1 MC MONITOR and attach to the Horizontal input of the oscilloscope. Next, connect the output of the Frequency Time Standard to the Vertical input of the same scope. Adjust the scope controls so that a symmetrical lissajous pattern is seen on the tube. If the lissajous pattern is stationary, the oscillator will not require adjustment. Recalibration will be necessary, however, if the pattern appears to be moving.

b. Adjust Capacitor C18, located on the crystal oven plug-in socket, until the lissajous pattern becomes stationary.

c. After the adjustment, all test equipment should remain connected for at least 1 hour to verify short term drift characteristics of the crystal oscillator. A small variance will be noted over this period of time, however, when properly adjusted, short term variations should average out over a longer period of operation.

If an oscilloscope is not available for calibration purposes, a second but slightly less accurate method of adjustment is possible by comparing the Model 734/735 time base with the Frequency Time Standard when it is used as the Channel A input frequency.

METHOD II

a. Connect the Frequency Time Standard to Channel A of the Model 734/735. Set the FUNCTION switch in the FREQ. position and the TIME BASE switch to $10^7$. Adjust the input controls for proper triggering. Set the RECYCLE control to the FAST position and adjust Capacitor C18 until a row of zeros consistently appears on the readout tubes. The reading will be accurate to $\pm 1$ count and meets the basic requirements of accuracy for the instrument.

b. The Frequency Time Standard should remain connected to the Model 734/735 for at least 1 hour to verify stable adjustment of the oscillator trimmer.

## 3.5 FACTORY REPAIR SERVICE

In the event that any Eldorado equipment requires service and trained personnel or test equipment are not locally available, we recommend that your nearest Eldorado Sales/Service representative be contacted for information and instructions. He will make every attempt to place the equipment back in good operating

condition, or he may suggest that it be returned to the factory for more extensive work. Eldorado's Customer Service Department is always prepared to supply repair parts and service for any of its instruments. Equipment sent to the factory for service is usually returned to the customer within two weeks after it is received. Address all inquiries for parts and service to Eldorado Electronics, Customer Service Department, 601 Chalomar Road, Concord, California 94520.

PARTS ORDERING INFORMATION
When ordering parts for an Eldorado instrument, specify the following information for each item ordered:

a. Model and Serial No.

b. Complete part description including: Assembly Designation, and Part Number.

NL 8421/

NIXIE

SUB FOR

BUR 1644A

# SECTION 4

## DRAWING INDEX AND DRAWINGS


1) Model 735 - Block Diagram . . . . . C-3-2029

2) Model 734 - Block Diagram . . . . . C-3-2888

3) Model 735 - Wiring Diagram . . . . . D-3-2168

4) Model 734 - Wiring Diagram . . . . . D-3-2542

5) Input Amplifier - Schematic Diagram . . . . . D-3-3492 ~~C-3-1996~~

6) Control Unit Driver - Schematic Diagram . . . . . D-3-2005

7) Control Unit - Schematic Diagram . . . . . C-3-1987

8) Signal Gate and Time Base Control Unit - Schematic Diagram . D-3-1923

9) Driver Circuit - Schematic Diagram . . . . . C-3-2086

10) Reference Frequency Shaper - Schematic Diagram . . . . . C-3-2307 ~~C-3-1922~~

11) Oscillator - Schematic Diagram . . . . . C-3-1989

12) 2.5 Mc DCU - Schematic Diagram . . . . . D-3-1882

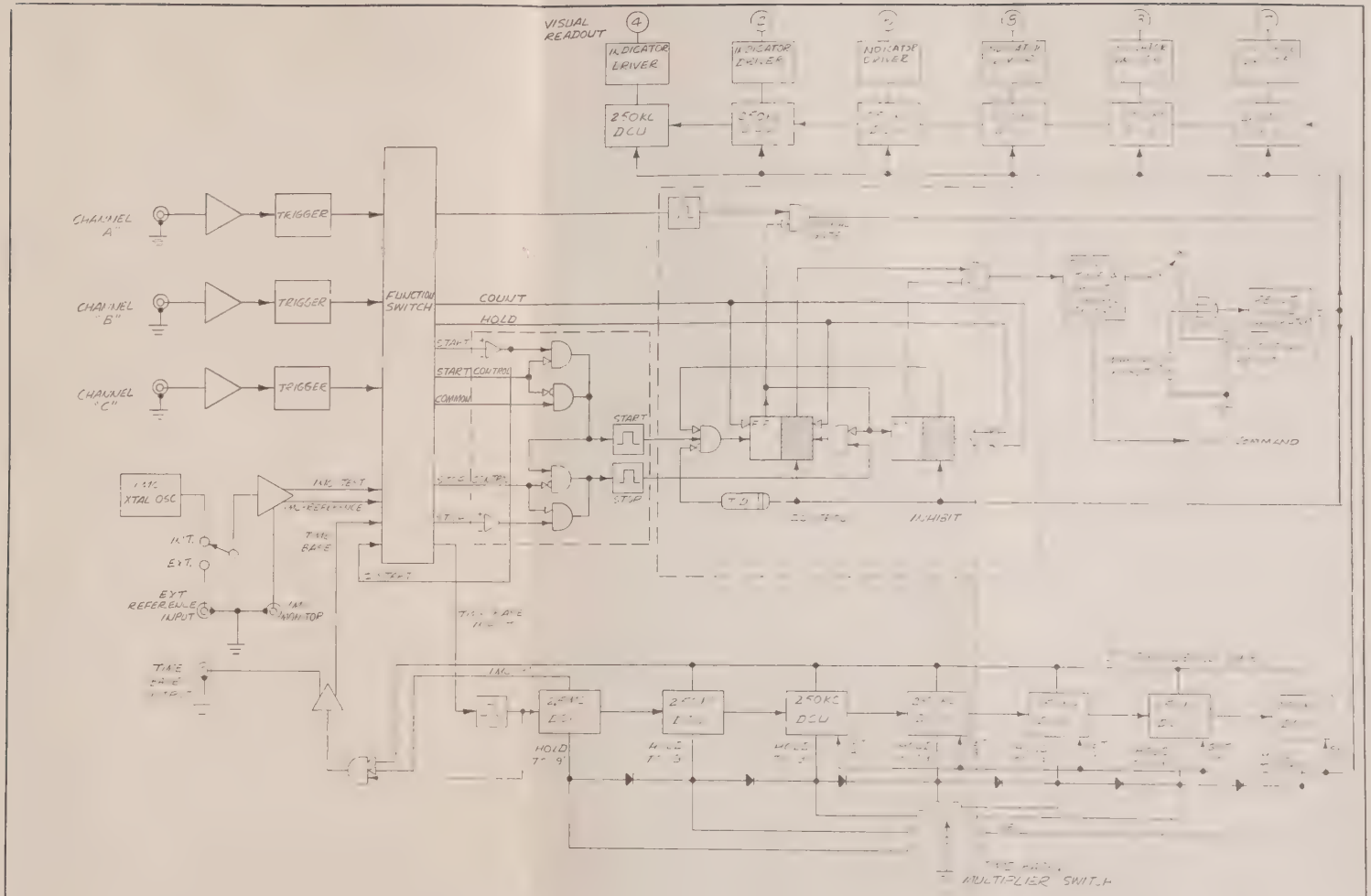
13) 250 Kc DCU - Schematic Diagram . . . . . D-3-1906

14) Memory Circuit - Schematic Diagram . . . . . C-3-2173

15) Reset Generator - Schematic Diagram . . . . . D-3-1962

16) Power Supply - Schematic Diagram . . . . . C-3-1866

17) Printer Readout - Connector Pin Designations



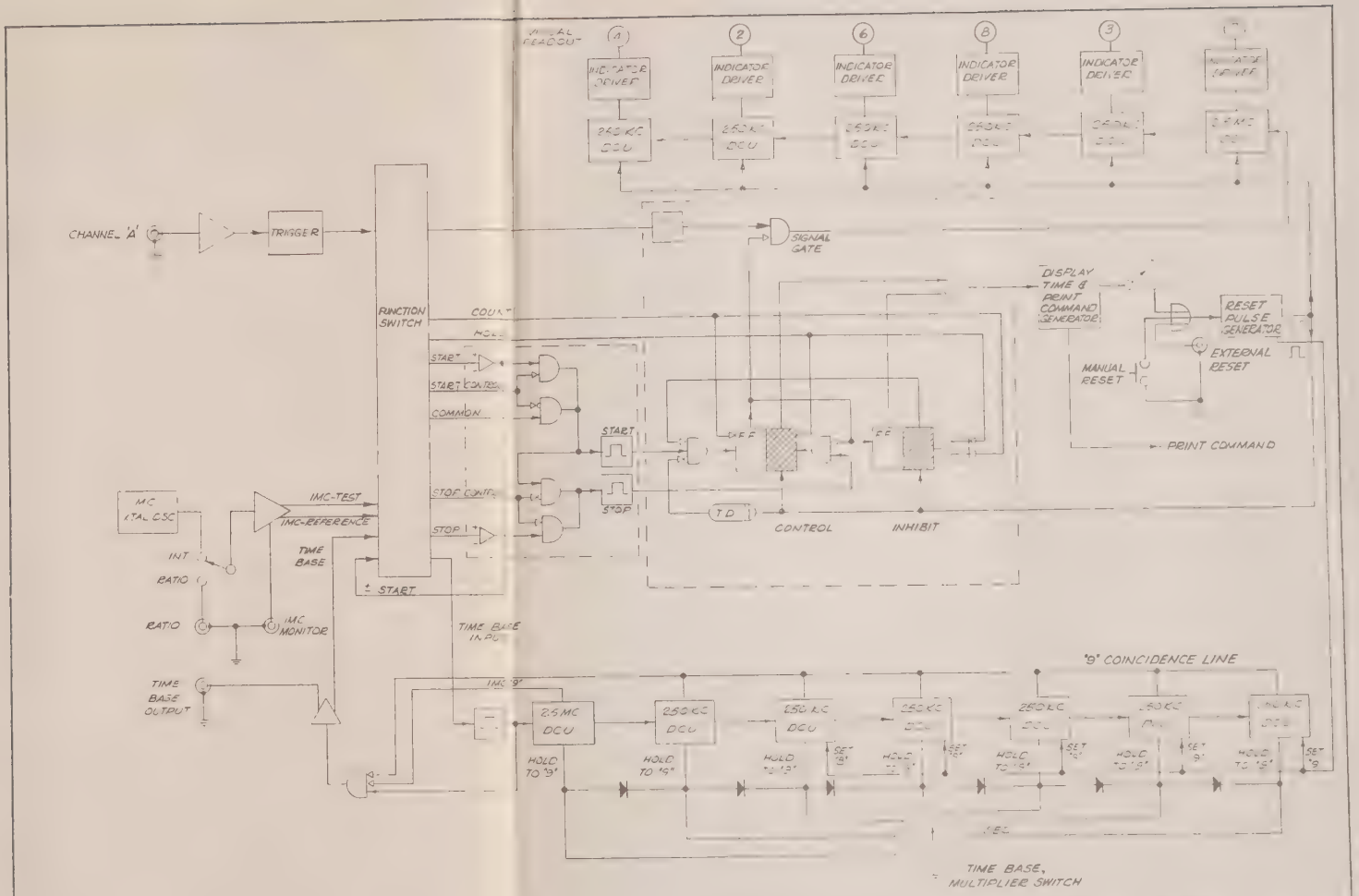

| | | | |
|---|---|---|---|
| FINISH | DWG CHNG | BY | DATE |
| MATERIAL | | | |
| TOLERANCE UNLESS NOTED<br>.00 ± .015 HOLE DIA .005<br>.000 ± .005 ANGLES 1° | | | |

**Eldorado Electronics**
Berkeley, California

| | | |
|---|---|---|
| DRAWN BY S.L. | DATE 7-2 | DO NOT SCALE THIS DRAWING |
| CHECKED | DATE | |
| APPROVED J.P.E. | DATE 7-63 | SCALE |

BLOCK DIAGRAM
MODEL 735

DWG NO C-5-2029 | ISSUE | MODEL




UNLESS NOTED
ALL RESISTORS ½W ±5%
ALL CAPACITORS 500V ±20%

UNITS IN Ω, F, & H
... p ...
001 ... n ... 10⁻⁹
... μ ... 10⁻⁶
... m ... 10⁻³
... k ... 10³
... M ... 10⁶

DWG CHNG | BY | DATE

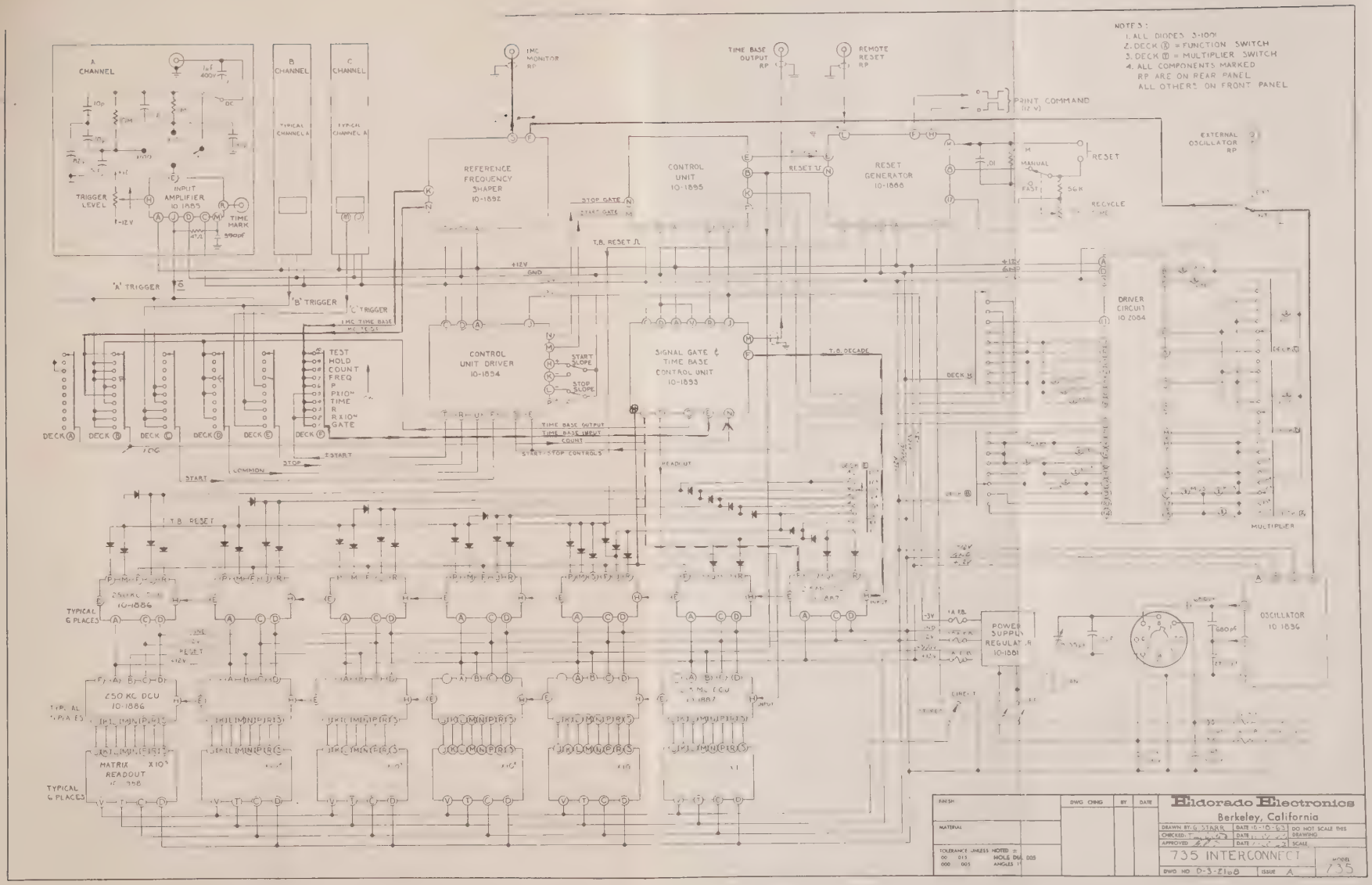
**Eldorado Electronics**
Berkeley, California

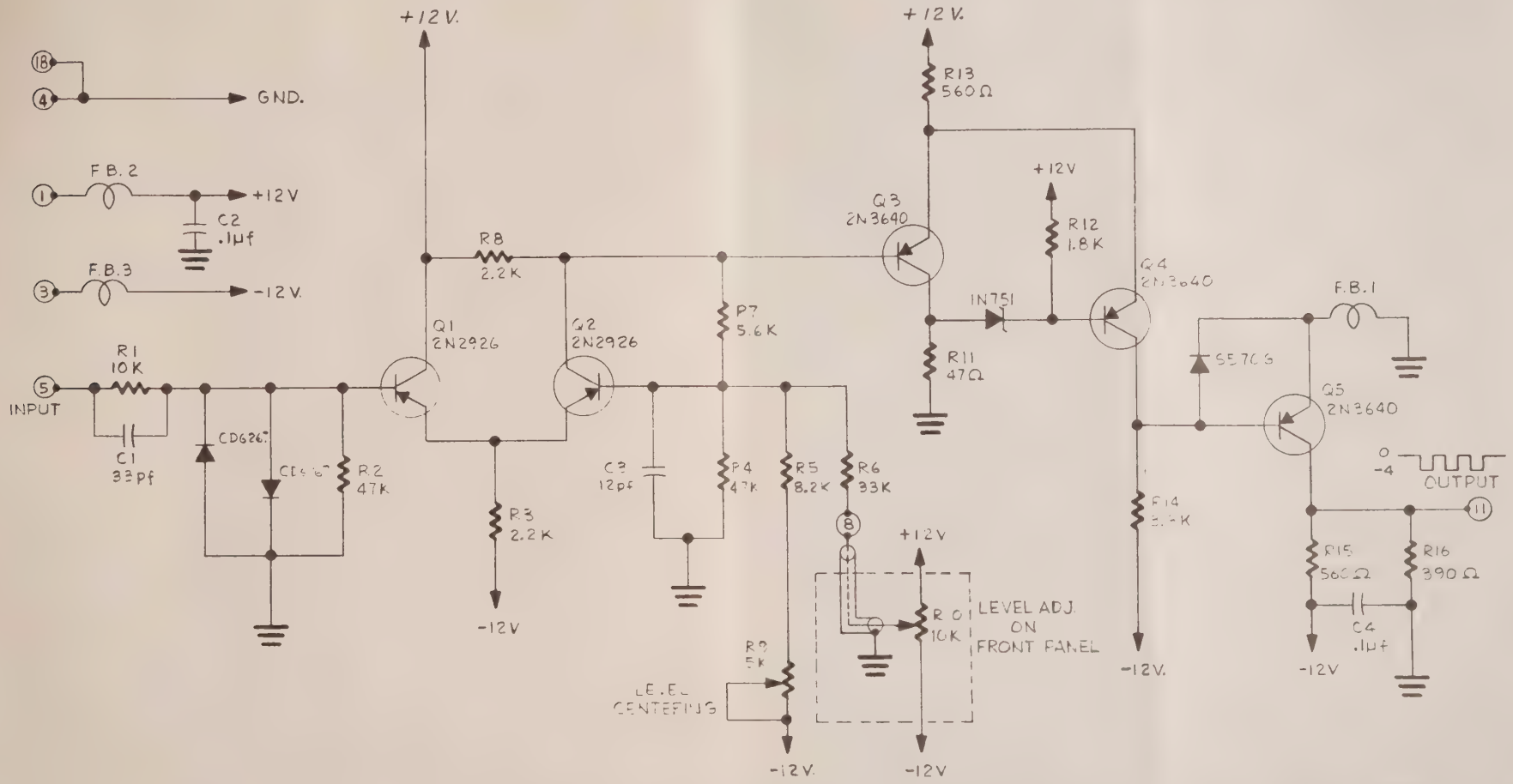
DRAWN BY | DATE
CHECKED J. IMPSON | DATE 3-76-
APPROVED | DATE

BLOCK DIAGRAM
MODEL 734

DWG NO C-3-2888 | ISSUE

MODEL 734


NOTES:
1. ALL DIODES 1-1001
2. DECK (A) = FUNCTION SWITCH
3. DECK (I) = MULTIPLIER SWITCH
4. ALL COMPONENTS MARKED RP ARE ON REAR PANEL ALL OTHERS ON FRONT PANEL
A CHANNEL
B CHANNEL
C CHANNEL
INPUT AMPLIFIER 10-1885
TRIGGER LEVEL
TIME MARK
IMC MONITOR RP
TIME BASE OUTPUT RP
REMOTE RESET RP
POINT COMMAND (12 V)
REFERENCE FREQUENCY SHAPER 10-1892
CONTROL UNIT 10-1895
RESET GENERATOR 10-1888
RESET
MANUAL
FAST
RECYCLE
EXTERNAL OSCILLATOR RP
STOP GATE
START GATE
T.B. RESET
+12V
GND
'A' TRIGGER
'B' TRIGGER
'C' TRIGGER
IMC TIME BASE
MC TEST
CONTROL UNIT DRIVER 10-1894
START SLOPE
STOP SLOPE
SIGNAL GATE & TIME BASE CONTROL UNIT 10-1893
T.B. DECADE
DRIVER CIRCUIT 10-2084
DECK (A)
DECK (B)
DECK (C)
DECK (D)
DECK (E)
DECK (I)
TEST
HOLD
COUNT FREQ
P
PRIOR TIME
R
RXIOM GATE
TIME BASE OUTPUT
TIME BASE INPUT
COUNT
START-STOP CONTROLS
START
STOP
COMMON
READ OUT
T.B. RESET
TYPICAL 6 PLACES
250 KC DCU 10-1886
MATRIX READOUT
MULTIPLIER
POWER SUPPLY REGULATOR 10-1881
OSCILLATOR 10-1836
FINISH
MATERIAL
TOLERANCE UNLESS NOTED
DWG CHNG
BY
DATE
Eldorado Electronics
Berkeley, California
DRAWN BY G. STARK
DATE 10-10-63
DO NOT SCALE THIS DRAWING
CHECKED
APPROVED
SCALE
735 INTERCONNECT
DWG NO 0-3-2168
ISSUE A
MODEL 735




| ITEM | DESCRIPTION | PART NO OR MATL | REV | MFG OR FINISH | LNG | QUAN | QUAN REQD | SS |
|---|---|---|---|---|---|---|---|---|
| WORK ORDER | QUAN START | ECR | DATE | ECR | DATE | ECR | DATE | |

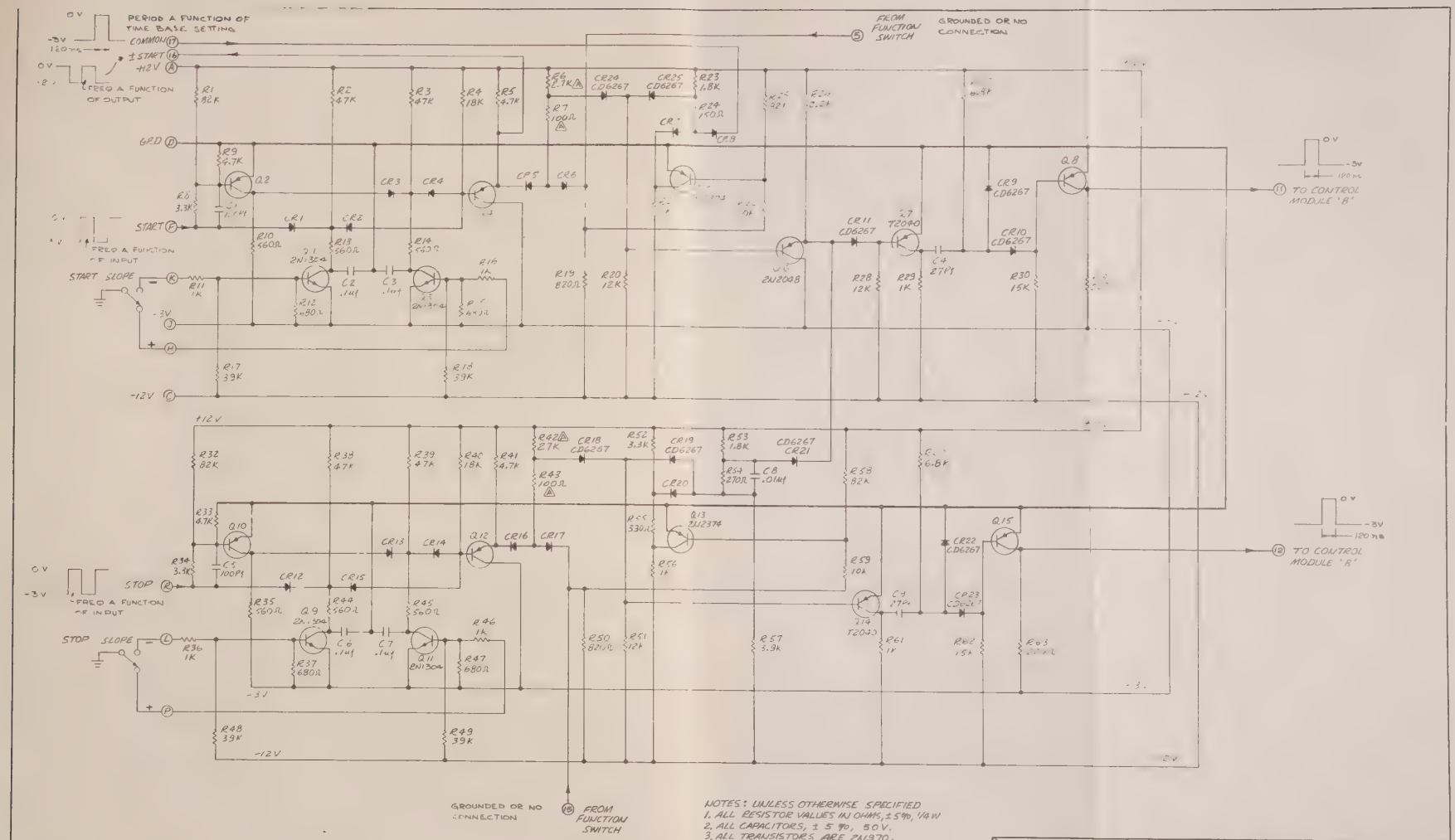
ELDORADO ELECTRONICS
EL CERRITO CALIFORNIA

TOLERANCES UNLESS NOTED
ELECTRICAL
ALL RESISTORS ± WATT 5% ALL TRANSISTORS
ALL CAPACITORS ALL DIODES
MECHANICAL
00 = ± 0½ HOLE DIA ± 005
000 = ± 005 ANGLES ± 1°
DIMENSIONS ARE IN INCHES
KEEP FREE FROM SCRATCHES BURRS AND TOOL MARKS

SCALE
DO NOT SCALE THIS DRAWING

DRW BY R.J.N. DATE 8-29-56
CK BY DATE
APP BY DATE

TITLE D.C. AMPLIFIER 25 M C
MODEL 734 / 735
DRW NO B-03-03432




NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES IN OHMS, ±5%, 1/4W
2. ALL CAPACITORS, ± 5%, 50V.
3. ALL TRANSISTORS ARE 2N370.
4. ALL DIODES ARE 3-1001.
5. ○ REFERS TO PCB CONNECTOR PIN DESIGNATION
6. ALL WAVE FORMS ARE NOMINAL

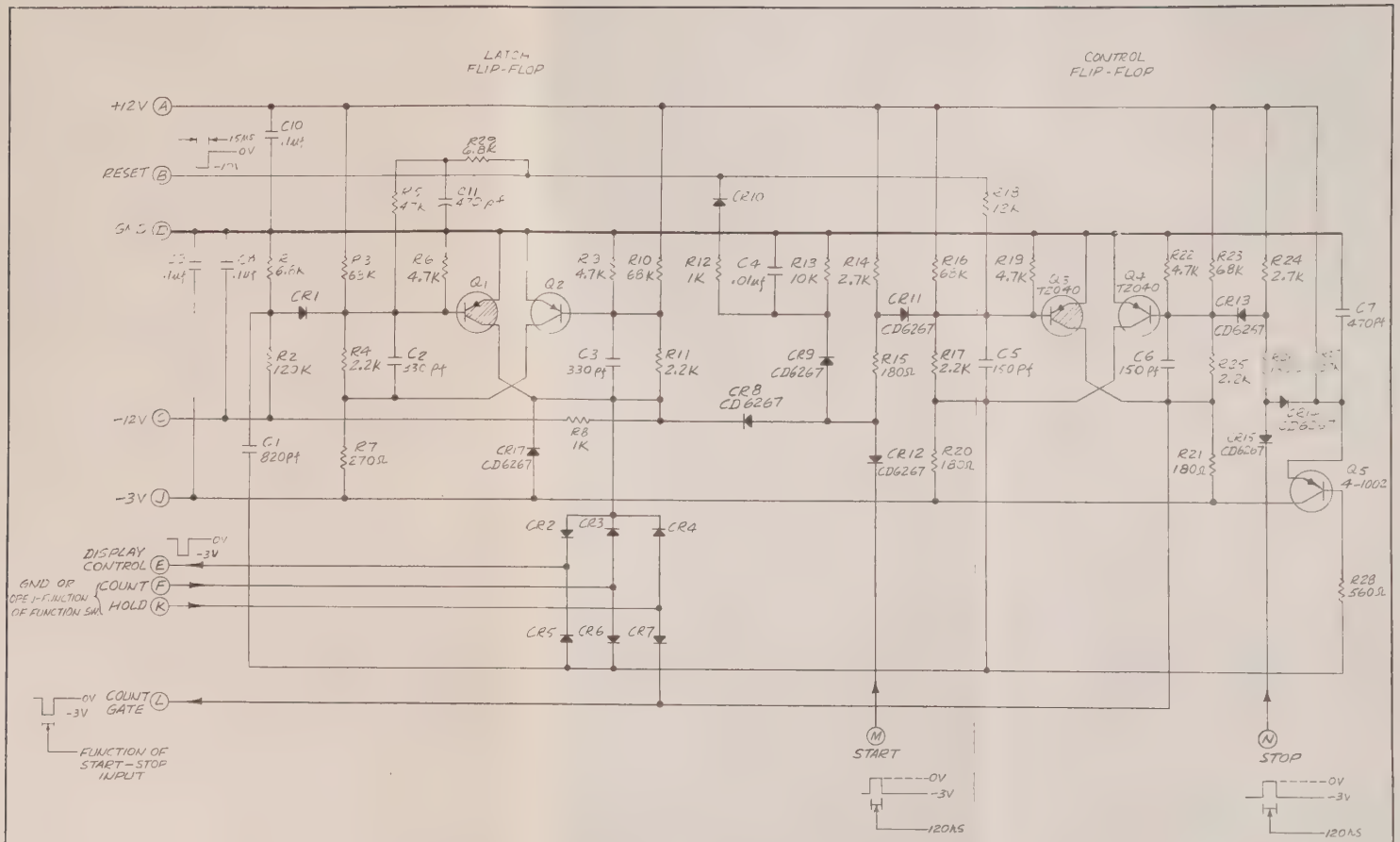
| R | CK | C | 2 |
|---|---|---|---|
| 63 | 25 | 9 | 15 |

UNLESS NOTED: ALL RESISTORS ¼W, ±5%; ALL CAPACITORS 50DV, ±20%

| DWG CHNG | BY | DATE |
|---|---|---|
| ECO 1142 | JE | 10-18 |

Eldorado Electronics
Berkeley, California

| | |
|---|---|
| DRAWN BY | DATE 5-20-65 |
| CHECKED | DATE |
| APPROVED | DATE |
| DWG NO D-7-205 | ISSUE A |
| MODEL 7-1 | |




NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES IN OHMS, ±5%, 1/4W
2. ALL CAPACITOR VALUES ±5%, 50V
3. ALL TRANSITORS ARE 2N970.
4. ALL DIODES ARE 3-1001.
5. ○ REFERS TO PCB CONNECTOR PIN DESIGNATION
6. ALL WAVE FORMS ARE NOMINAL.

| Q | CR | C | R |
|---|---|---|---|
| 4 | 17 | 11 | 29 |

P/L 10-1895

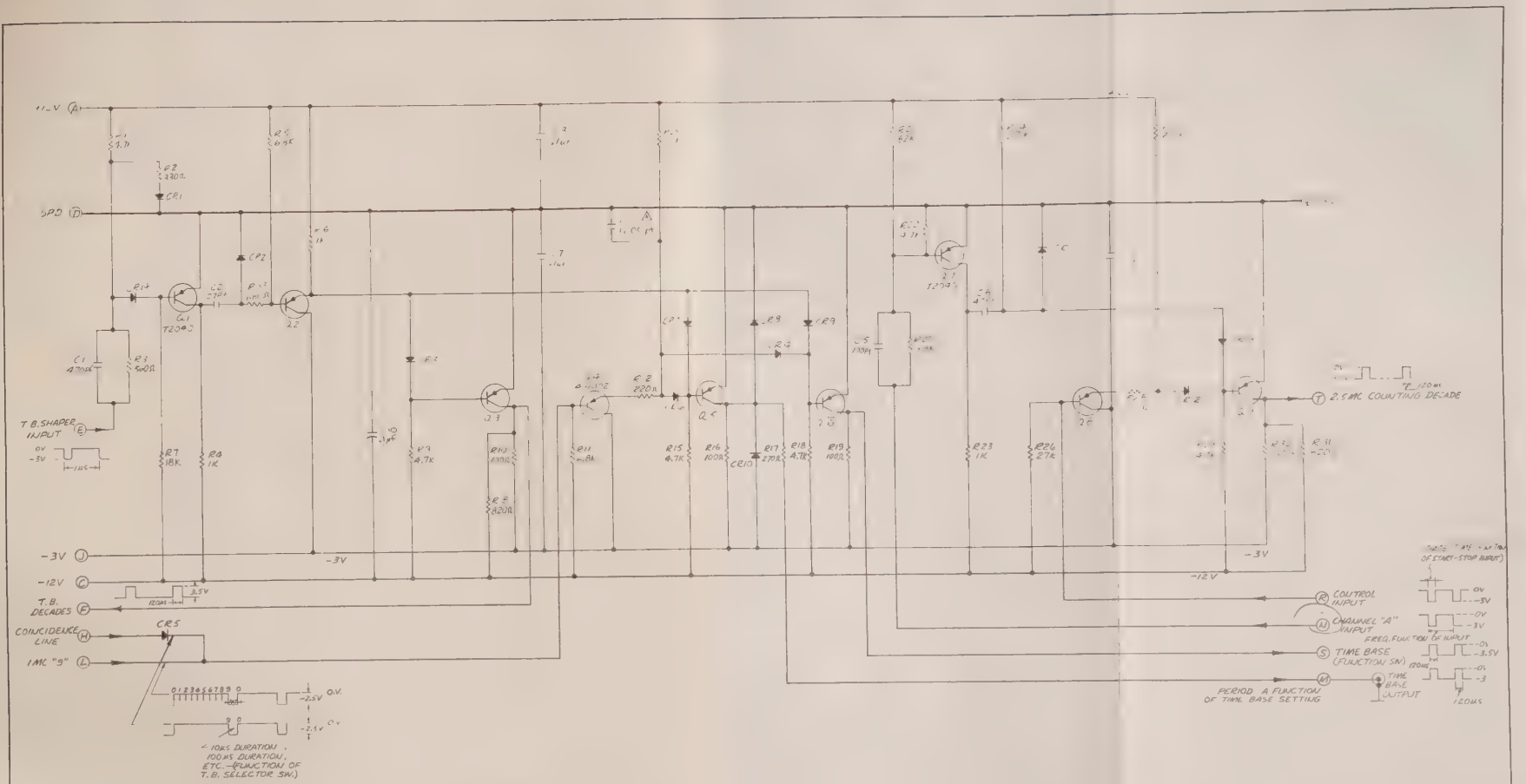
| DWG CHNG | BY | DATE |
|---|---|---|
| A ADD C11, R2* | | |
| B R23 was 68K | | |

FINISH
MATERIAL
TOLERANCE UNLESS NOTED ±
.00 = .015 HOLE DIA .005
.000 = .005 ANGLES 1°

**Eldorado Electronics**
Berkeley, California

| | | |
|---|---|---|
| DRAWN BY: S.L. | DATE 5-7-63 | DO NOT SCALE THIS DRAWING |
| CHECKED | DATE 7-22-63 | |
| APPROVED | DATE 11-27-63 | SCALE: |

CONTROL UNIT
DWG. NO. C-3-1987 ISSUE B
MODEL 735



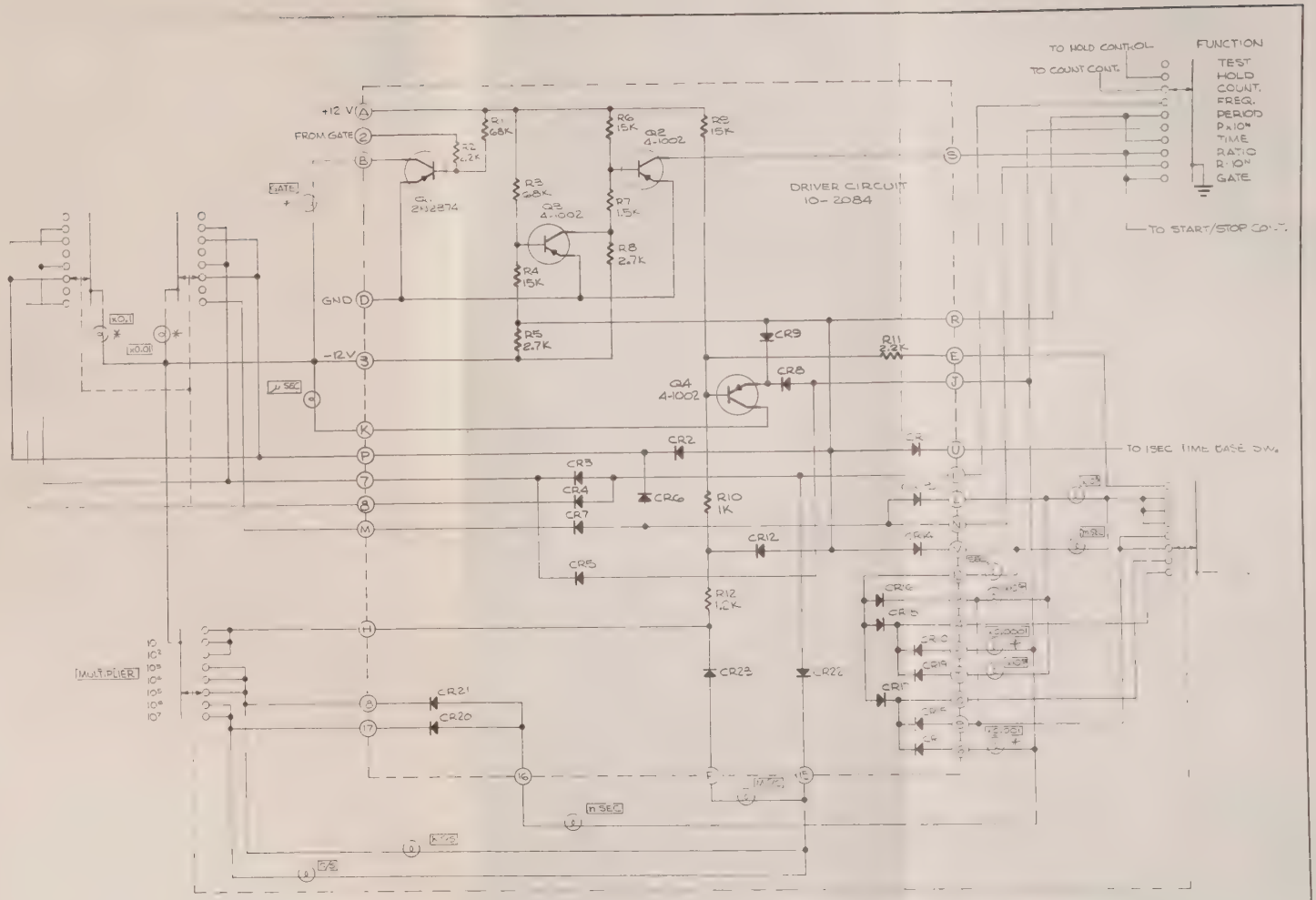

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE 2N970.
2. ALL DIODES ARE CD6267.
3. ALL RESISTOR VALUES IN OHMS, ±5%, 1/4W
4. ALL CAPACITOR VALUES ±5%, 50V
5. ○ REFERS TO PCB CONNECTOR PIN DESIGNATION
6. ALL WAVESHAPES ARE NOMINAL.

| Q | CR | C | R |
|---|---|---|---|
| 5 | 14 | 10 | 13 |

Eldorado Electronics
Berkeley, California

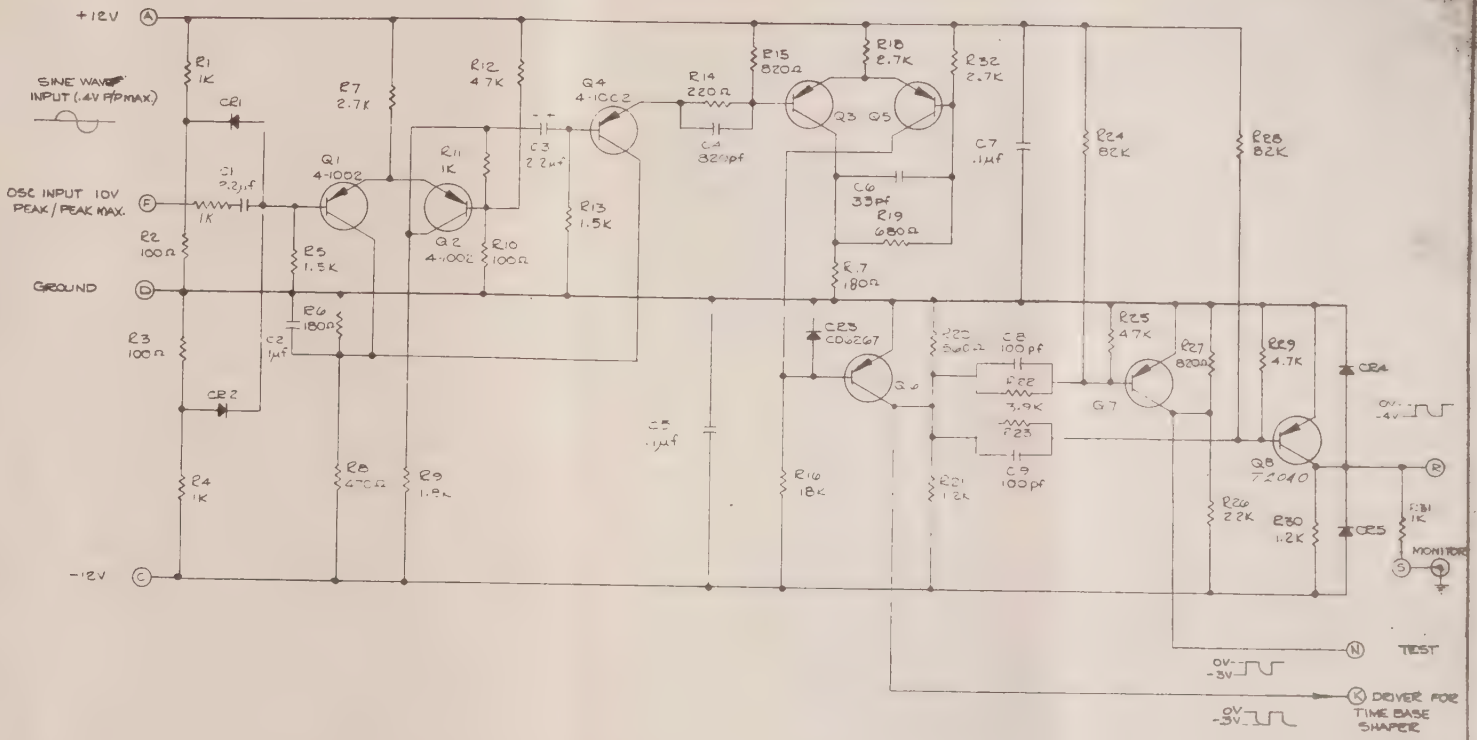
SIGNAL GATE & TIME CONTROL UNIT

DWG NO D-3-1323 ISSUE A MODEL 335




NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ¼ W, ±5%
2. ALL DIODES 3-1001
3. ALL LITES 14V @ 80MA #330
4. * 25V @ 40MA #327

| | | | | |
|---|---|---|---|---|
| FINISH | DWG CHNG | BY | DATE | Eldorado Electronics, Berkeley, California |
| MATERIAL | | | | DRAWN BY — DATE 7-31-62 — DO NOT SCALE THIS DRAWING |
| TOLERANCE UNLESS NOTED: .00 = .015 HOLE DIA .005; .000 = .005 ANGLES 1° | | | | CHECKED — DATE 7-31-62 |
| | | | | APPROVED — DATE 11-27-62 — SCALE: — |
| | | | | SCHEMATIC DRIVER CIRCUIT — MODEL STD |
| | | | | DWG NO C-3-2086 — ISSUE |




6. ALL WAVE SHAPES ARE NOMINAL (PERIOD OF OUTPUT, A FUNTION OF INPUT).
5. Ⓧ REFERS TO CONNECTOR PIN DESIGNATION.
4. ALL RESISTOR VALUES IN OHMS, ± 5%, 1/4W
3. ALL CAPACITOR VALUES ± 5%, 50V MIN.
2. ALL DIODES ARE 3-1001.
1. ALL TRANSISTORS ARE 2N970.

NOTES: UNLESS OTHERWISE SPECIFIED.

FAB # 5-1981
T/L # 10-2251

UNLESS NOTED
· ALL RESISTORS ½W. ±5%
ALL CAPACITORS 500V. ±20%

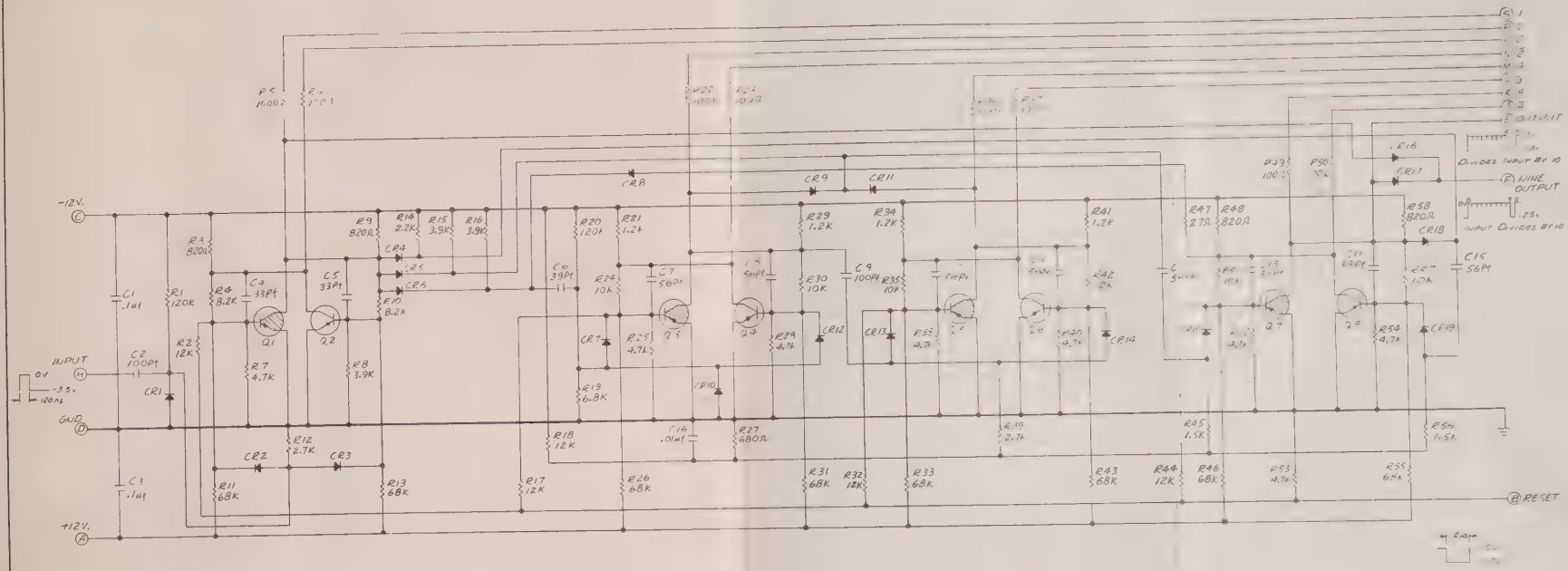
UNITS IN Ω, F, & H
µµ = p = $10^{-12}$
.001µ = n = $10^{-9}$
µ = $10^{-6}$
m = $10^{-3}$
K = $10^{3}$

| DWG CHNG | BY | DATE |
|---|---|---|
| | | |

Eldorado Electronics
Berkeley, California

| | | |
|---|---|---|
| DRAWN BY: R. BOHN. | DATE 1-10-64 | SCALE: NO SCALE |
| CHECKED | DATE 2-7-64 | |
| APPROVED | DATE 2-10-64 | |

REFERENCE FREQUENCY SHAPER




NOTE: ALL WAVEFORMS ARE NOMINAL

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE 2N1499A
2. ALL RESISTORS ARE 1/4 W ±5%.
3. ALL DIODES ARE CD6267
4. ALL CAPACITORS ARE ±5%, 100V.
5. ○ REFERS TO PCB CONNECTOR PIN DESIGNATION

| Q | CR | C | R |
|---|---|---|---|
| 8 | 19 | 15 | 56 |

UNLESS NOTED

UNITS IN Ω, F & H
M — 10⁶
K — 10³
m — 10⁻³
μ — 10⁻⁶
n — 10⁻⁹
p — 10⁻¹²

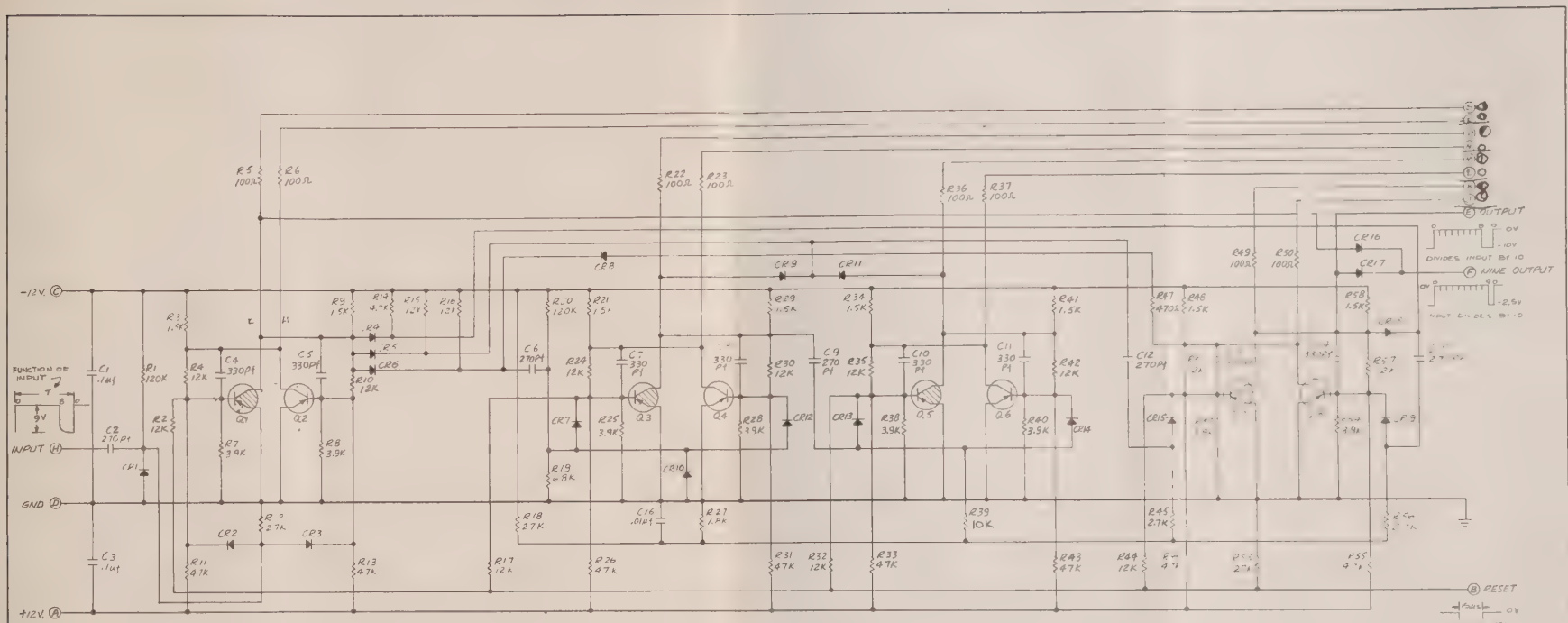
| DWG. CHNG | BY | DATE |
|---|---|---|
| | | |

Eldorado Electronics
Berkeley, California

| | |
|---|---|
| DRAWN BY S. L. | DATE 5-17-61 |
| CHECKED | DATE 7-22-61 |
| APPROVED | DATE 10-19-61 |

2.5 MC DCU
SCHEMATIC

DWG NO D-3-1552 | ISSUE | MODEL STD




NOTE:
ALL WAVEFORMS ARE NOMINAL

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE 4-1002.
2. ALL RESISTORS ARE 1/4 W ±5%.
3. ALL DIODES ARE 3-1001.
4. ALL CAPACITORS ARE ±5%. 500V.
5. ○ REFERS TO PCB CONNECTOR PIN DESIGNATION

| Q | CR | C | R |
|---|---|---|---|
| 8 | 19 | 15 | 57 |

UNLESS NOTED
UNITS IN: Ω K & M
pF p 10⁻¹²
MFD μ 10⁻⁶
n 10⁻⁹
m 10⁻³
K 10³
M 10⁶

DWG. CHNG | BY | DATE

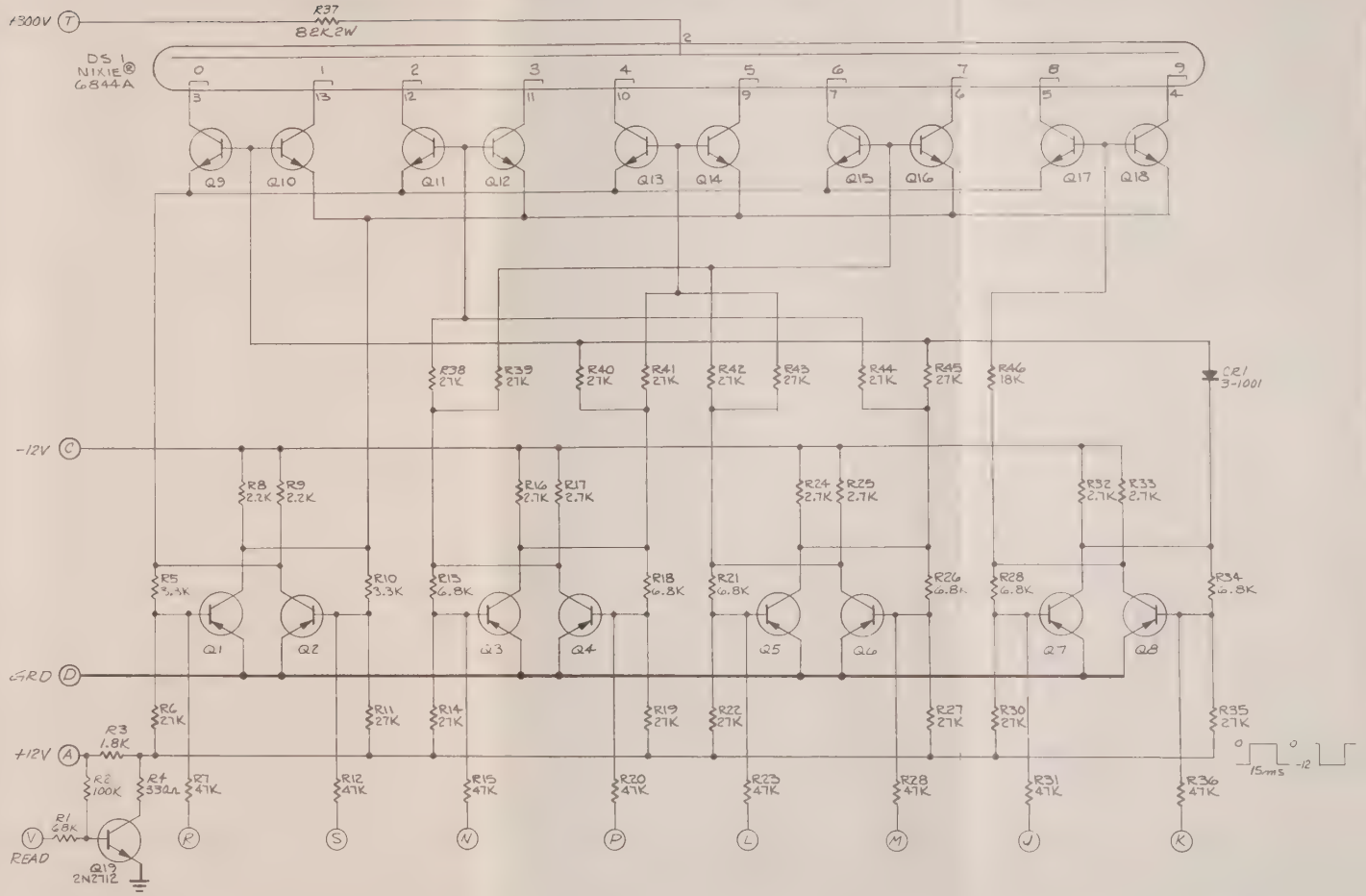
Eldorado Electronics
Berkeley, California

DRAWN BY | DATE
CHECKED | DATE 1-23-67
APPROVED | DATE 1-17-67

250KC DCU
SCHEMATIC

DWG NO D-3-1906 | ISSUE | MODEL STD

P/C 10-1886




NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES IN OHMS ±5% 1/4W
2. TRANSISTORS: Q1 THRU Q8 = 4-1002
   Q9 THRU Q18 = 4-1001
3. (X) REFER TO P.C.B CONNECTOR PINS

| R | CR | Q | DS |
|---|---|---|---|
| 46 | 1 | 19 | 1 |

P/L 10-1988

| DWG CHNG | BY | DATE |
|---|---|---|
| | | |

FINISH

MATERIAL

TOLERANCE UNLESS NOTED ±
.00 = .015 ANGLES 1°
.000 = .005

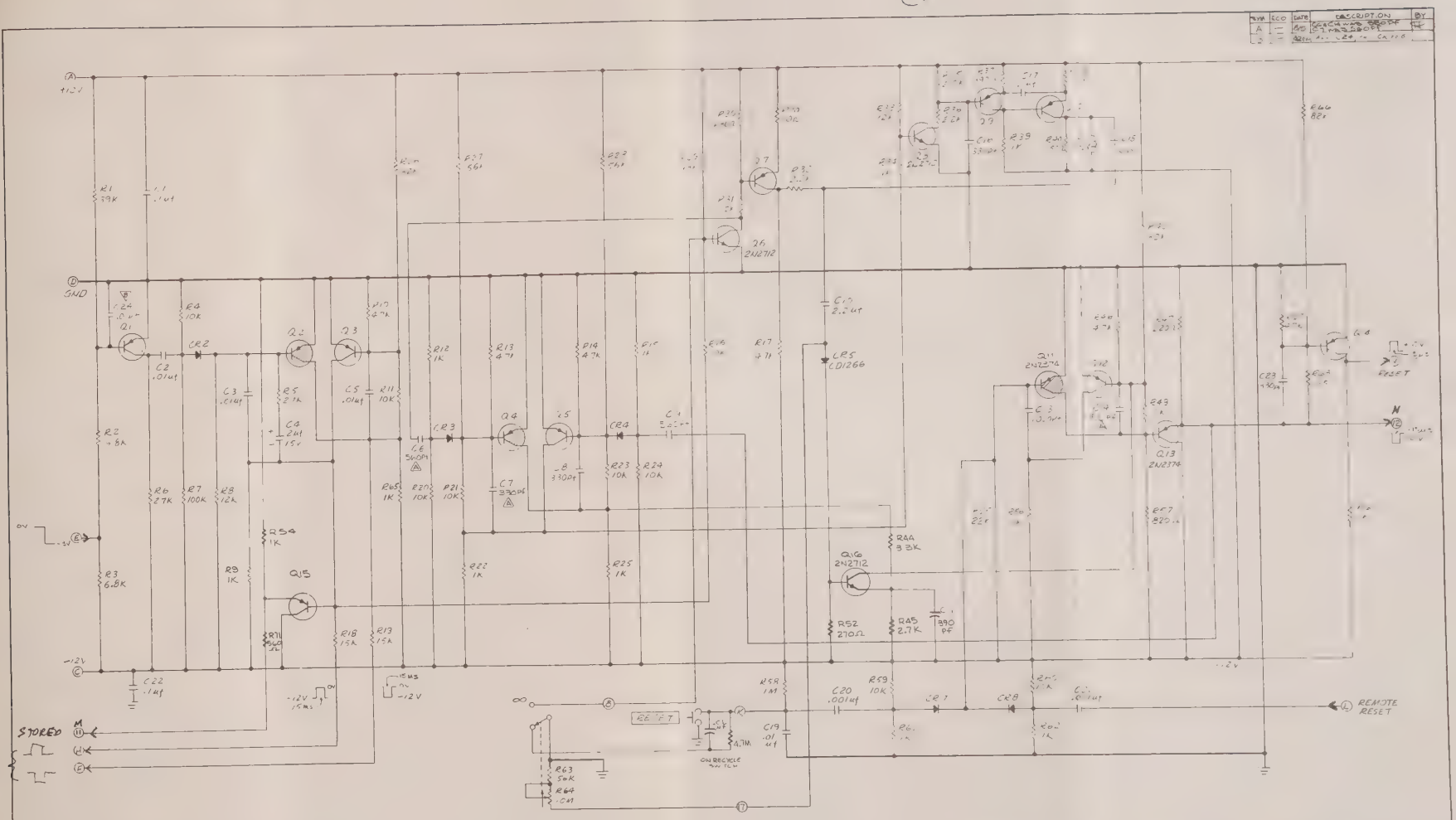
Eldorado Electronics
Berkeley, California

| | | |
|---|---|---|
| DRAWN BY | DATE 7-31-63 | DO NOT SCALE THIS DRAWING. |
| CHECKED | DATE 10-28-63 | |
| APPROVED | DATE 10-28-63 | SCALE: |

SCHEMATIC DIAGRAM
MEMORY CIRCUIT

DWG NO C-3 2173 ISSUE

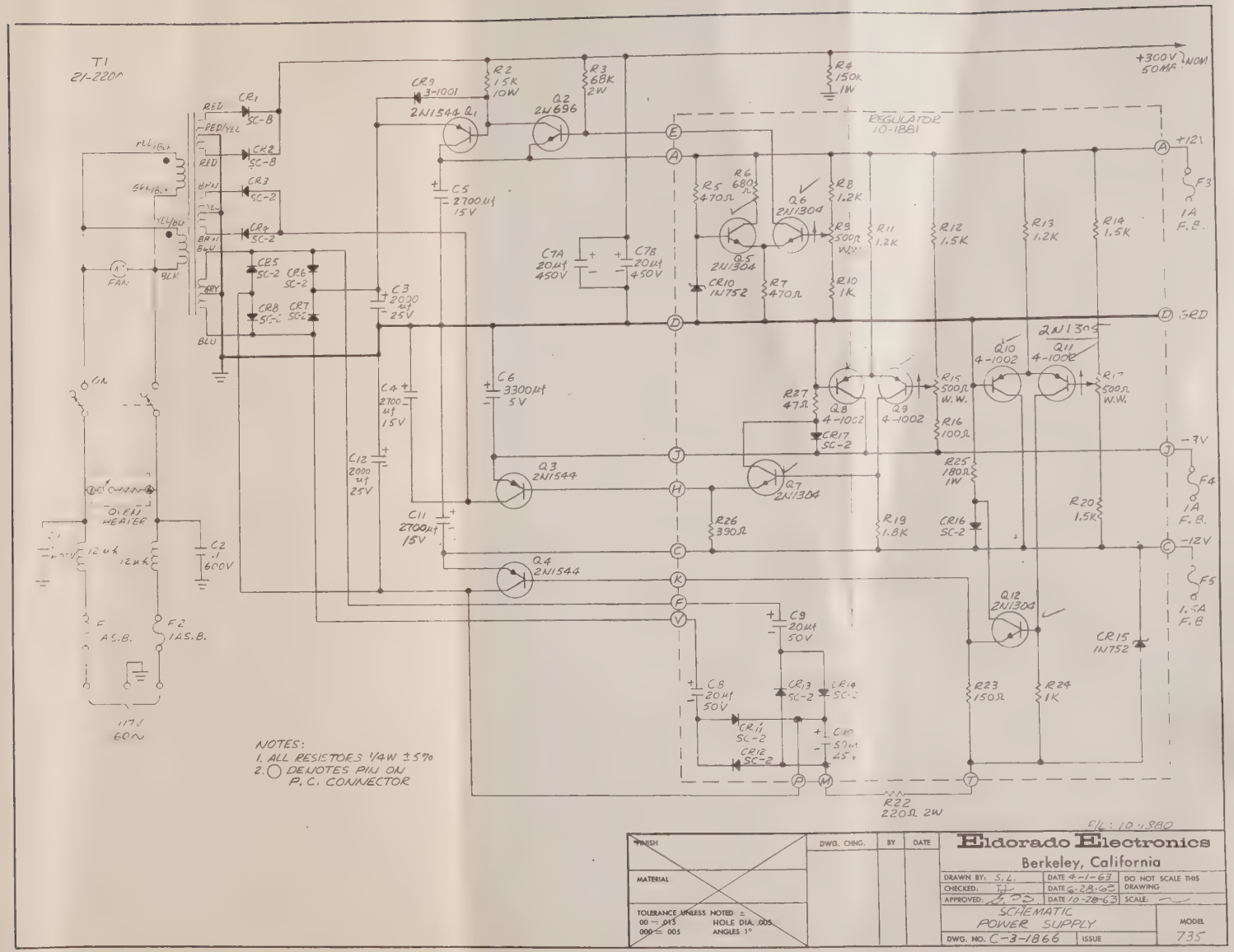
MODEL STD




NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE 4-1002.
2. ALL DIODES ARE 3-1001.
3. ○ DENOTES PIN ON P.C. CONNECTOR.
4. ALL RESISTOR VALUES IN OHMS, ±5%, ½W
5. ALL CAPACITORS, ±5%, 50V
6. ALL WAVE FORMS, NOMINAL

| C | CP | C | K |
|---|---|---|---|
| 14 | 5 | 24 | 10 |

Eldorado Electronics
Berkeley, California
SCHEMATIC
DWG NO D-3-1962 ISSUE B
MODEL 335




| FINISH | DWG. CHNG. | BY | DATE |
|---|---|---|---|
| MATERIAL | | | |
| TOLERANCE UNLESS NOTED: .00 — .015 HOLE DIA. .005; .000 — .005 ANGLES 1° | | | |

**Eldorado Electronics**
Berkeley, California

| | | |
|---|---|---|
| DRAWN BY: S.L. | DATE 4-1-63 | DO NOT SCALE THIS DRAWING |
| CHECKED: T.L. | DATE 4-28-63 | |
| APPROVED: [illegible] | DATE 10-28-63 | SCALE: |

SCHEMATIC
POWER SUPPLY

DWG. NO. C-3-1866 | ISSUE | MODEL 735

D/L: 10-1880

PRINTER READOUT

CONNECTOR PIN DESIGNATIONS

Connector pin designations shown below are for Amphenol #57-40500. Printout code is 1-2-4-8 BCD; dc levels, "0" =(-)0.3 volts or less, "1" = (-) 9.0 volts nominal.

| DECADE | BINARY CODE | | | |
|---|---|---|---|---|
| | 1 | 2 | 4 | 8 |
| 1 | 1 | 2 | 26 | 27 |
| 2 | 3 | 4 | 28 | 29 |
| 3 | 5 | 6 | 30 | 31 |
| 4 | 7 | 8 | 32 | 33 |
| 5 | 9 | 10 | 34 | 35 |
| 6 | 11 | 12 | 36 | 37 |
| 7 | 13 | 14 | 38 | 39 |
| 8 | 15 | 16 | 40 | 41 |
| 9 | 17 | 18 | 42 | 43 |

Positive Print Command Output (-) 10 volts to 0 volts - Pin 23.

Negative Print Command Output 0 volts to (-) 10 volts - Pin 48.

(-)10 volt Printer Reference Level - Pin 24.

Ground - Pin 25.

## WARRANTY

Eldorado instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes or transistors, except as they are warranted by their manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense (see Repairs) during such period and which has not been subjected to misuse, neglect, improper installation, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied, or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

## RECEIVING INSPECTION

Every Eldorado instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

## REPAIRS

When an Eldorado instrument requires service, the nearest Eldorado representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary. In the latter case, the instrument must be dispatched freight prepaid, with insurance coverage arranged by the customer. Freight and insurance on the return trip to the customer will be arranged by Eldorado and charged to the customer.

## SHIPPING DAMAGES

In any case where damage occurs in transit, Eldorado's obligations under warranty are dependent on the customer's immediately notifying the carrier, so that inspection can be made and a claim filed.

Please specify both model and serial number in all correspondence concerning Eldorado instruments. Address all inquiries regarding Eldorado instruments to your nearest sales representative or Sales Manager, Eldorado Electronics Company, 601 Chalomar Road, Concord, California (94520).

MP MASTER
MA29725